

8.—ECOLOGICAL NOTES ON THE DE GREY-COONGAN AREA, WITH SPECIAL REFERENCE TO PHYSIOGRAPHY.

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INTRODUCTION.

The area covered in this paper extends along the De Grey River from mouth to the junction with Bamboo Creek, i.e., a distance of about ninety miles, in the north and along the Port Hedland-Marble Bar Railway in the south. Most of the months May and June, 1941, were spent in this area and a large collection of the local flora was made.

The climate is semi-arid with very high summer temperatures. It is not unusual for the mercury to be over the century at its maximum for a week or so at a time. The rainfall which is predominantly summer in incidence, varies from about twelve to eight inches as one proceeds inland. The break in the dry weather is often marked by violent storms which cause great wind and flood damage. In other years the rains may fall over three or four months between December and March. There is a marked winter drought.

PHYSIOGRAPHY.

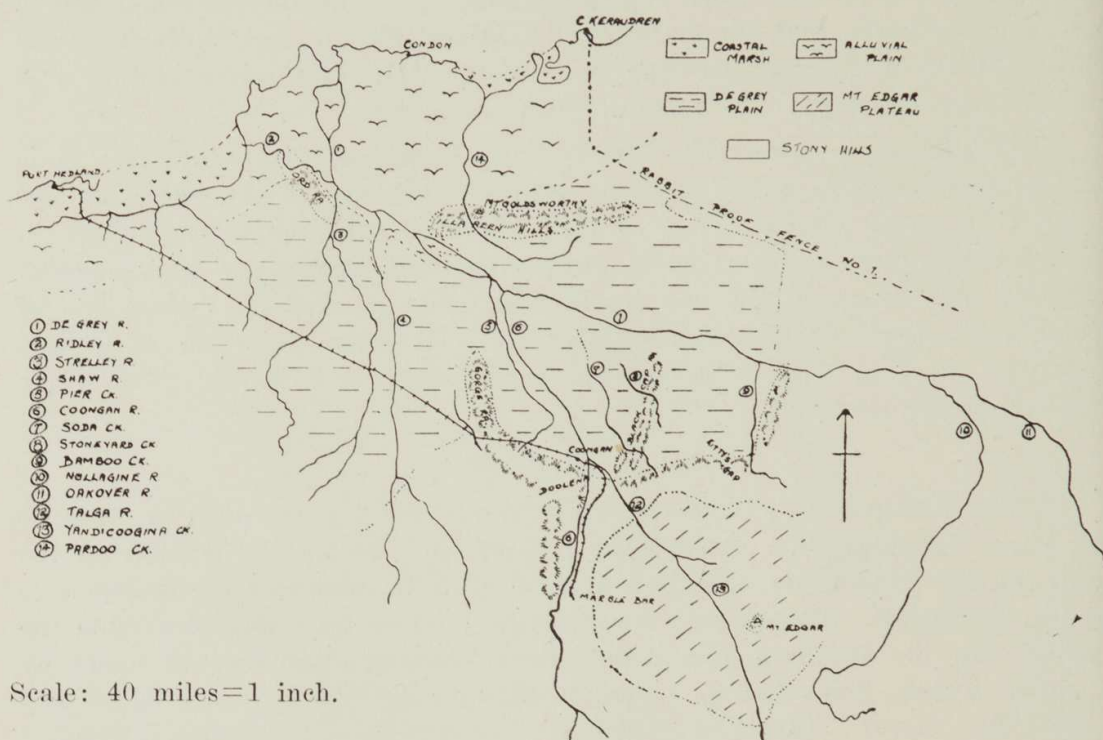
To understand the variations in the vegetation it is essential to visualise the chief physiographic features of the region. As will be noticed on the map the De Grey River runs in a general W.N.W. direction across the area under discussion. Throughout its course it receives no tributaries from the north. On the southern side it is joined (moving from east to west) by Bamboo Creek, Soda Creek, Coongan River, Pier Creek, Shaw River and the Strelley River. Just west of the last junction the delta system is reached and the course divides into the De Grey and Ridley channels. The former branches again and then rejoins before reaching the sea.

North of the De Grey is Pardoo Creek which during part of its course runs parallel to the river. Pardoo Creek has its own outlet to the sea.

Except for an alluvial plain along the coast (which includes the delta of the De Grey) the country between the railway and the river is a granitic plain. The general landscape is flat or gently undulating. In some places the plain is interrupted by ridges of low hills where there are outcrops of metamorphosed sediments. According to Gibb Maitland (1908) these rocks belong to the Warrawoona Series while the granite of the plain is a young formation. Of the hills the following may be listed:—Ord Range (or Muccingarra Hills) between Port Hedland and the De Grey, Illareen Hills (which include Mount Goldsworthy) to the north of the De Grey and traversed by the Pardoo Creek, Gorge Range between the Shaw and Coongan rivers and the Black Cap Hills which run north from Coongan Siding to the De Grey River and further. A gabbro dyke causes the latter. There are various other ridges of hills without names. In all cases the hills rise very abruptly from the plain. In some places there are gaps in the ridges where creeks pass through. (See Plate II, Fig. 1.)

To the south of the granitic plain is a change of country where a low ridge of hills is reached. These are about the same height as those of the plain but there are series of ridges extending southwards to beyond Marble Bar. The hills are composed of metamorphosed sediments of Warrawoona and Nullagine age. It is in this rough hilly region that the rivers and creeks arise.

South-east from Marble Bar, where Mount Edgar Station lies, the country changes again into a rock strewn plateau which in this paper is referred to as the Mount Edgar Spinifex Plateau. Mount Edgar itself is a pyramidal hill, composed of rock of Warrawoona age, which dominates the granitic plateau. South of the plateau is more of the rough stony hill country.



Text Fig. 1.

The country can be divided into the following sections:—(i) Water courses. (ii) De Grey Spinifex plain. (iii) Stony Hills, and (iv) the Mount Edgar Spinifex Plateau.

(i) The river channels consist of sandy courses which may be as much as a mile wide in the flat country, viz., the Coongan River in some of its lower reaches. The coarse sand, which is light buff in colour, includes many large pebbles brought down from the stony hills. The wide channels are formed of a series of streams between which there are sand and pebble banks built up during flood periods. Permanent waterholes are to be found at various places along the rivers.

The fall of the plain towards sea level is very gradual and it might be expected that the river courses would meander. This is not so though the courses turn and twist a certain amount. The explanation is that in flood time when the whole channel is full the water is at top speed and its course is as straight as possible. When the floods recede the water occupies only the minor channels in the river bed.

The soil of the channels is more closely related to that of the stony hills than to that of the plain.

In the hills the creeks run in steep stony gullies. On the plateau they are more like those of the plain except that there is less sand and more rock material in the beds.

(ii) The De Grey Spinifex Plain extends from a few miles north of the river to the hills just south of the railway and from the alluvial plain on the coast to Bamboo Creek in the east. The soil is a red sandy loam varying to red sand. The colour is always darker and richer than that of the river sand.

(iii) The stony hills present a very arid appearance. The soil is scanty and lies between the numerous boulders on the treeless slopes.

South of Coongan siding the Coongan River is joined by the Talga River. Both these rivers have their gaps in the hills. The former passes through Doolena and the latter through Talga Gap. It is through the latter that the railway enters the hilly country. South of the gap the Talga course is to the east and this country has not been seen by the author. The railway and road follow a southward course parallel to the Coongan River.

(iv) In some features the Mount Edgar Plateau resembles the De Grey Plain. The soil is however lighter in colour and more sandy in nature. Out-crops of granite are very common. Mount Edgar itself is not granitic. The more important streams include the Talga River and Yandicoogina Creek with its tributaries.

ECOLOGY.

No close study was made of the alluvial plain along the coast except adjacent to the De Grey River. The vegetation consists of a beach zone of mangrove swamps, a sand dune and salt marsh zone, which is influenced by some of the exceptionally high tides at some periods of the year, and then a transition zone into the spinifex plain.

The rest of the area can be treated under the main physiographic headings.

(i) Water Courses.

- (a) Rivers with woodland association.
- (b) Creeks without woodland association.
- (c) Stony gullies in the hills.
- (d) Small drainage courses.

(a) The vegetation along the rivers is dominated by the eucalypts, Blackbutt, River Gum (*Eucalyptus microtheca*), and Bloodwood (*E. dichromophloia*). The centre of the river course is a bare desolate scene of dry sand banks and piles of river gravel. On either side of this however, the eucalypts stand in a prolific growth of various species of grasses. These include *Eulalia fulva*, *Chrysopogon pallidus*, *Sorghum plumosum*, *Bothriochloa decipiens*, *Heteropogon contortus*, *Themeda australis*, *Iseilema premaea*, *Brachiaria Clementii*, *B. piligera*, *Panicum cymbiforme*, *Ichnanthus australiensis*, *Setaria Dielsii*, *S. Carnei*, *Xerochloa laniflora*, *Sporobolus actinocladius*, *S. pulchellus*, *Eriachne Benthamii*, *Eriachne aristidea*, *E.*

glauca, *E. obtusa*, *Diplachne parviflora*, *Eragrostis japonica*, *E. Basedowii*, *E. Dielsii*, *Leptochloa digitata*, *Neurachne Clementii* and other species. The introduced grasses *Cenchrus ciliaris* and *Cenchrus pennisetiformis* (Buffel Grasses) have assumed a dominant role along the lower stretches of the De Grey up to its junction with the Coongan River. Above this point and along the tributaries the native grasses retain their position. Non-Gramineous species include *Gomphrena Michelli*, *Tribulus terrestris*, *T. occidentalis*, *Polanisia icosandra*, *Indigofera trita*, *I. viscosa*, *Cucumis trigonus* and others but the grasses are dominant among the ground flora. (See Plate I, Fig. 1.)

Between the bare sand channels and the lateral grassy woodland, which varies greatly in depth, there is every possible gradation. Along the main course there are pools of varying size and importance from small pools to large permanent water holes. For a few months the pools are connected by shallow trickles of water. Around most pools and along any running water there is a zone dominated by small sedges. These include *Bulbostylis barbata*, *Cyperus bulbosus*, *C. aristatus*, *C. difformis*, *C. iria*, *C. ixiocarpus*, *C. Cunninghamii*, *C. vaginatus*, *Fimbristylis microcarpa*, *F. miliacea*, and *Eleocharis atropurpurea*. The sedges are associated with such species as *Eragrostis japonica*, *E. Basedowii* and *Calandrinia quadrivalvis*. *Chara* sp. is abundant in many pools and in running water.

On the high river banks outside the woodland, i.e., the main banks of the course, there is a zone of *Triodia angusta* N.T.B., ms. and *Triodia secunda* N.T.B., ms. which gradually merge into the *Triodia pungens* R. Br. of the spinifex plain.

Below the junction of the De Grey and Coongan the main river course is bordered by a flood plain which increases in width until it merges into the delta system below the Ridley junction. Along the flood plain the woodland association mingles with the *Triodia pungens* association while the latter retreats from the river until at the delta there are wide grass plains. Much of these grass plains has been overrun by the introduced Buffel Grasses but there is plenty of country still carrying native grasses. In some places there are patches of pure *Chrysopogon pallidus* covering many acres. The same can be said of *Eriachne Benthamii* which can be seen on the great mudflats where the silts carried down by the flood waters are deposited. The former grass is cut for hay. The latter is practically useless from a pastoral point of view.

The fine silts of the delta area overlies soil with water highly impregnated with mineral salts and so stock water is difficult to obtain. From reports it seems that the vegetation varies greatly from season to season according to the amount of flood water which reaches the area. Probably the soil becomes increasingly salt during a cycle of years without a flood. The flood, when it comes, deposits a new layer of silt and also, probably leaches some of the salt away. This type of country, which lies between the woodland association along the river and the sand dunes and mangrove swamps of the coast, carries a growth of *Sporobolus virginicus* a species which has two growth forms according to the condition of the soil. In salty country it forms erect culms 8-12 inches high in a dense mat while in better country it is a diffuse plant with long trailing culms up to twelve feet in length. In seasons of floods *Sporobolus* is associated with a vigorous development of *Trigonella suavissima*. This legume however takes a very obscure place during seasons without flooding.

(b) Creeks whose courses are not marked by development of the grassy woodland association are found both on the De Grey plain and on the Mount Edgar plateau. The banks of these creeks carry the same species of *Eucalyptus* and most of the grasses can be collected along the sand banks but there is no defined association and the grasses are mostly isolated plants. *Eriachne Benthamii* is one of the most abundant however, and it may extend along the creeks in a pure state for a hundred yards or so in some places. There is an increase in the number of shrubs present. These include *Acacia trachycarpa*, *Carissa lanceolata*, *Abutilon amplum* and *Cassia venusta*. The banks also carry many tussocks of *Triodia angusta* with an occasional one of *Triodia pungens*. Along the creek on the plateau there is a decrease in the number of trees and an increase in the number of species of *Acacia*. These include *Acacia pachycarpa*, *A. salicina*, *A. tumida* and *A. patens*. *Cassia oligophylla*, *Adriana tomentosa* and various smaller shrubs are also important.

(c) The steep gullies in the hills are drained by creeks whose beds contain piles of boulders. The water must drain very rapidly from such channels. The creeks are marked by an occasional Eucalypt and by other species such as *Ficus platypoda*, *F. orbicularis*, *Terminalia circumalata*, *Acacia trachycarpa* and smaller species such as *Corchorus parviflorus* var. *ovatus* and *Trichinium auriculifolium*.

The creeks as they emerge from the hills spread out into a number of distributaries. Sometimes there is no definite course left after a mile of the plain has been traversed.

(d) Under this heading the author has included all minor drainage courses on the plain and also claypans. The former are marked by a thicker line of trees and shrubs than is the surrounding plain. In the latter cases there are communities of species of *Spinifex* other than *Triodia pungens*. These are *Triodia angusta*, *Triodia secunda*, which are species near to *T. microstachya* R. Br., and *T. longiceps* J. M. Black. This last is particularly common on the Mount Edgar Plateau.

(ii) De Grey Spinifex Plain.

The plain has been defined under the physiographic section. On the northern side of the river the plain merges into the desert country where *Plectrachne Schinzii* replaces *Triodia pungens*. Pardoo Creek traverses some of the transition country. To the east of Bamboo Creek is unknown country to the author. The plain may be discussed under the following headings:—

- (a) *Triodia pungens* association.
- (b) *Plectrachne Schinzii* association.
- (c) Other species of *Triodia*.

(a) This is by far the most important association on the plain. It is found with or without associated trees such as *Eucalyptus dichromophloia*, *Dolichandrone heterophylla* and *Atalaya hemiglauca* and shrubs such as *Acacia pyrifolia*, *Carissa lanceolata* and species of *Abutilon*, *Sida*, *Corchorus*, *Cassia* and various legumes. (See Plate I, Fig. 2.)

The growth form of *Triodia pungens* is extremely variable. It may be

(i) a pyramidal tussock up to three or four feet in diameter, of dense

habit and much resinous secretion on the leaf sheaths. This is a coars form which is common on the plain. It is accompanied by a sparse development of trees and shrubs. (ii) a smaller tussock with very dark green leaves and very resinous leaf sheaths. It is the commonest form on the spinifex plain and is found in similar country to (i). (iii) A low flat tussock with dark green leaves. It may grow up to 6-7 feet in diameter and only a foot or so high. The older portions die away leaving a central dead patch. It has shorter leaves than the above types. It is usually found in country carrying a good growth of shrubs. (iv) A small dense tussock with yellowish leaves. This is an easy form to recognise in the field. It has a very wiry leaf whose blade is closed even when growing, though in the other forms the blade is open. It grows in open country with (i) and (ii). (v) A loose sprawling form with long trailing culms which have erect tufts rooted to the soil. This is the so-called Runner spinifex. It appears in country similar to that of (iii).

It may be stated here that there are no reliable taxonomic differences between these forms. The distinction is only possible in the field. These perennial tussock grasses dominate the landscape for many square miles. The association is a form of shrub steppe.

(b) The *Plectrachne Schinzii* association is locally referred to as pindan. This native word has been used rather generally in the North-West. However, for scientific purposes, it was defined by Gardner (1923) as a form of low sclerophyllous woodland in which the average height of the trees is 25 feet. He expressly states that it is not a grassland development. Further south than the Kimberleys, where Gardner studied this type of association, the word is applied to spinifex country which carries a large number of shrubs of certain species, particularly species of *Acacia*. The trees are all small and under 25 feet high. The author has decided to define this country as "spinifex pindan," i.e., sandy country carrying either *Plectrachne Schinzii*, or a species of *Triodia* in association with shrubs and trees up to twenty feet high. The trees often occur in thickets.

Spinifex pindan owing to the lower fodder value of the grass species and to the more arid habitat is sometimes referred to as desert country. Along the 80-Mile Beach the distinction can be made between *Triodia pungens* pindan and *Plectrachne Schinzii* pindan. In the De Grey country this division cannot be made. Here spinifex pindan occurs as patches in the general *Triodia pungens* association of the plain.

The shrubs and trees include *Atalaya hemiglauca*, *Dolichandrone heterophylla*, *Grevillea agrifolia*, *Acacia tumida*, *Acacia holosericea*, *A. pachycarpa* and *A. pyrifolia* as well as mallee forms of *Eucalyptus dichromophloia* and *E. setosa*. The smaller shrubs include *Cassia oligophylla*, *C. desolata*, *Indigofera monphylla*, *Isotropis atropurpurea*, *Acacia translucens*, *Keraudrenia integrifolia*, *Corchorus Walcottii* and *Melaleuca lasiandra*.

(c) *Triodia lanigera* was found forming colonies within the *Plectrachne* association. It appeared to favour habitats where the pindan sand was mixed with numerous quartz pebbles.

Other species of *Triodia* include those dealt with under subsection (d) of the previous section. These species sometimes occur as small colonies on the open plain.

(iii) *The Stony Hills.*

The stony hills carry a modified form of the *Triodia pungens* association of the plain. The trees and shrubs almost disappear except in the gullies. The vegetation along the creeks has already been discussed.

The form of *Triodia pungens* is a small tussock with very short culms and long leaves. *Triodia brizoides* N.T.B., ms., is a glaucous species with slender very pungent pointed leaves. It occurs on some slopes. (See Plate I, Fig. 2.)

When the spinifex cover is destroyed by fire there is a vigorous growth of *Polanisia icosandra*, *Tribulus hirsutus*, *T. Forrestiana*, *Didiscus hemiparva* and *Trichinium auriculifolium*.

Among the shrubs are *Indigofera monophylla*, *Solanum diversifolium*, *Solanum phlomoides*, *Trichinium incanum*, *Triumfetta appendiculata* and various species of *Corchorus*. The trees include very occasional specimens of *Eucalyptus* and *Ficus platypoda*.

(iv) *The Mount Edgar Spinifex Plateau.*

The Mount Edgar Spinifex Plateau, except along the creeks, is lacking in eucalypts. The only mesophanerophytes are *Acacia pyrifolia* which only just attains this class, *Hakea lorea* and *Grevillea pyramidalis*. The ground cover is composed of *Triodia pungens* with a similar tussock to that described under (ii) in the De Grey Spinifex Plain. Where this cover is removed by fire there is a growth of annuals which include *Polanisia icosandra*, *Mollugo molluginis* and *Tribulus hirsutus*. Malvaceous and Tiliaceous shrubs are abundant.

The plateau is rock strewn and there are piles of granite boulders everywhere. Near such outcrops *Triodia longiceps* is common. This is a coarse glaucous species with leaf blades rigid, pungent and up to twelve or sixteen inches long. The tussocks may be up to five feet in diameter and four in height. The tall shrub *Clerodendron floribundum* was found growing among the boulders. Various species of *Tephrosia* particularly *T. Bidwilli* were very common.

The pindan association was not seen in this locality. Its absence together with the general lack of eucalypts, the small number of growth forms of *Triodia pungens* and the edaphic differences serves to distinguish the area from the De Grey Spinifex Plain.

Below the different habitats are analysed using Raunkiaers method:—

Area.	No. of Species.	M.M.	M.	N.	Ch.	H.	G.	HH.	Th.	E.	S.
De Grey-Coongan	334	0.8	7.2	15	6.5	9	....	1.5	58	....	....
Water Courses	195	1.5	3	5	2	11	....	2	73	....	....
Spinifex Plain	150	....	10	18	6	10	....	....	53	....	....
Stony Hills	93	....	3	30	18	15	....	....	38	....	....
Mt. Edgar Plateau	121	....	13	21	15	13	....	....	36	....	....

SUMMARY.

The area bordered by the coast in the west, the courses of the De Grey River and Pardoo Creek in the North, Bamboo Creek and Mount Edgar in the east and by the Marble Bar-Port Hedland railway in the south is discussed under the headings of physiography and ecology. These two aspects are closely related.

The whole area is within the ecological region where *Triodia pungens* is the dominant form.

The following divisions are recognised:—(i) Water Courses with and without grassy woodland association, (ii) De Grey Spinifex Plain, (iii) Stony Hills, (iv) Mount Edgar Spinifex Plateau.

REFERENCES.

- Gibb Maitland: The Geological Features and Mineral Resources of the Pilbara Goldfield. *Geol. Surv. West. Aust. Bull.* 40, 1908.
- Gardner, C. A.: Botanical Notes on the Kimberley Division of Western Australia. *Forests Dept. Bull.* 32, 1923

EXPLANATION OF PLATES.

PLATE I.

Fig. 1.—River Woodland Association, *Leptochloa digitata* in the foreground. Muccan Station, De Grey River.

Fig. 2.—De Grey Spinifex Plain. *Triodia pungens* associated with *Hakea lorea*, *Carissa lanceolata* and *Acacia pyrifolia*. Warralong Station.

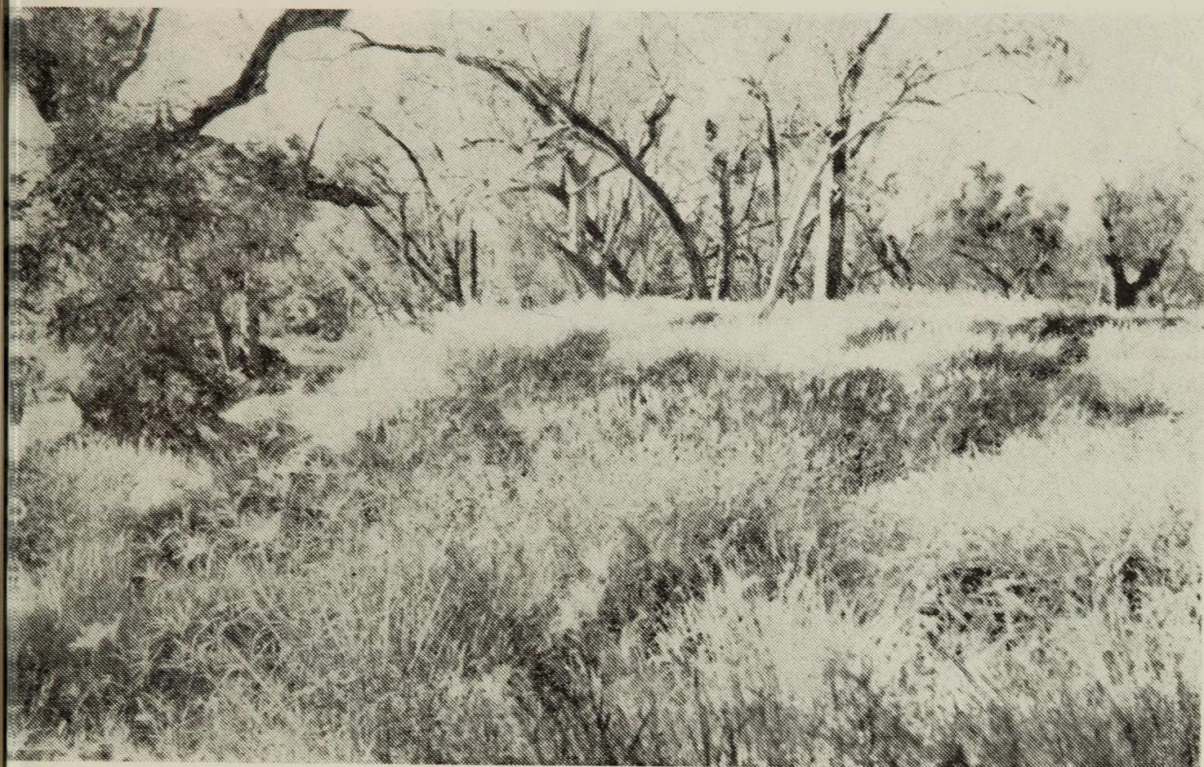


Fig. 1.



Fig. 2.

NATIONAL HERBARIUM OF VICTORIA

PLATE II.

Fig. 1.—Stoneyard Creek Gap in the Black Cap Hills. Hills rise abruptly from the De Grey Spinifex Plain, which is treeless in this locality. Muccan Station.

Fig. 2.—Kitty's Gap, showing typical stony hill vegetation.



Fig. 1.



Fig. 2.